Geophysical Research Abstracts,
Vol. 11, EGU2009-3331-1, 2009
EGU General Assembly 2009

Response of Biogeochemical Processes to Recent Sea Ice Decreasing in Arctic Chukchi Sea and Canadian Basin

J. Chen (1,2), H. Jin (2), H. Li (2), Z. Liu (2), and H. Zhang (2)

(1) State Key Laboratory of Satellite Ocean Environment Dynamics, Second Institute of Oceanography, SOA, Hangzhou 310012, China, (2) Laboratory of Marine Ecosystem and Biogeochemistry, Second Institute of Oceanography, SOA, Hangzhou 310012, China

Because of its sea ice cover the Arctic Ocean has not been considered as a sink of atmospheric carbon dioxide. With recent observations of decreasing ice cover due to global warming there is the potential for an increasing of biological pump efficiency, especially in Arctic Chukchi Sea and Canadian Basin where upper ocean nutrients transported from Bering Sea are very abundant. During three Icebreaker Xuelong cruises of Chinese Arctic Expeditions in summers in 1999, 2003 and 2008, we analyzed nutrients, DO, chl a, opal, primary productivity and carried out nutrients enrichment experiments on board. The results showed that sea ice in summer decreased very rapidly since 1999. Silicate and nitrate were largely depleted along the 170°W longitude section from Bering Strait to Canadian Basin while phosphate was over 0.5μM in most areas during three cruises, with a slight decadal decrease trend of nutrients suggesting uptake increase due to longer open ocean period within a year. Nutrients enrichment experiments suggested that there was silicate and nitrate co-limitation in central Canadian Basin in summer 2008 where only 10-20% sea ice cover. Average water column chl a concentrations were 2.79, 2.42 and 2.89 μg/L in 1999, 2003 and 2008 respectively with the chl a maximum at depth between 20-40m in shelf area and 20-70m in deep basin. Interestingly, chl a maximum became deeper in early September than it in late July along the 170°W section in 2003 and 2008, suggesting subsurface nutrients would also be utilized when upper ocean nutrients was depleted. The size fraction analysis of chl a showed that about 70% of chl a was contributed by >20μ phytoplankton while nano- and pico- plankton were minor contributors. Size fraction of opal analysis (>20μ and 0.8-20μ) in water column also supported that large phytoplankton predominated. The active biological pump in water column lead to higher chl a concentration in multicore sediments, highest sedimentary chl a (core top, 0-1cm) was measured as high as 254 μg/g sediment, and average chl a concentration in central Chukchi Sea was 6.7 μg/g, which was one order higher than that in typical higher productivity Chinese coastal area such as Changjiang Estuary and its adjacent East China Sea. Organic carbon burial rate increased from bottom to top in three cores with accompanying by increasing of sedimentary chl a suggested that biological pump increased due to sea ice decrease since the last century. Our preliminary results suggest that as one of the largest shelves in the world (one-forth of world shelves), as well as its sufficient nutrients supply (north Pacific Ocean, large rivers), Arctic Ocean might play a very important role in global carbon sink when sea ice shrinks.